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## Two New Marine Ostracoda (Crustacea: Myodocopina: Cypridinidae) from Shimoda, Izu Peninsula, Central Japan

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Two new cypridinid ostracods, *Skogsbergia abei* and *Paravargula maculosa*, are described based upon specimens collected from shallow bottom sands using a baited trap at Shimoda, Izu Peninsula. This is the first record of these genera from Japan.

**Key Words:** Ostracoda, Cypridinidae, *Paravargula*, *Skogsbergia*, new species, Japan.

### Introduction

In recent years one of the present authors (KY) and students of the late Dr Kazumi Abe of Shizuoka University have found more than ten cypridinid ostracod species, including the bioluminescent *Vargula hilgendorfii* (G. W. Müller, 1890), at Shimoda on the Izu Peninsula. Most of these taxa are in need of further taxonomic study, and it is probable that a number will be new to science. The present paper deals with two new cypridinids, one of the genus *Skogsbergia* and the other of *Paravargula*, based on specimens collected from Tatado and Sotoura, Shimoda. These are the first records of both genera from Japan.

### Materials and Methods

Ostracods were collected from Tatado (sand bottom, 3–5 m depth, 138°56'E, 34°39'N) and Sotoura (sand bottom, 2–4 m depth, 138°59'E, 34°41'N), Shimoda City, Izu Peninsula, central Japan, using a baited trap (Abe *et al.* 1995). Each sampling site was located on a sandy beach approximately 350 m long, bounded by rocky shores. Dissected appendages were mounted on slides using Hoyer's Solution, and the carapaces are preserved in 70% ethanol. Genitalia were processed with hexamethyldisilazane (HMDS) (Nation 1983) for examination by SEM (JEOL JSM-T330A, accelerating voltage of 3 kV).

The type specimens are deposited in the Zoological Institute, Faculty of Science, Hokkaido University (ZIHU).

## Taxonomy

Genus *Skogsbergia* Kornicker, 1974

*Skogsbergia abei* sp. nov.

(Figs 1–5)

**Description.** *Female* (holotype). Carapace (Figs 1A, B, 2A–E) 2.15 mm long, 1.30 mm high, oval in lateral view, with deep incisur and narrow caudal process. Surface smooth. Anastomosing pattern of integumental circulatory system (Vannerier and Abe 1995) visible in lateral view (Fig. 1A, B). Rostral infold with about 17 bristles; about eight bristles of different lengths present along ventral margin of rostrum. Infold in anterior and anteroventral regions with about 20 “divided bristles” (Kornicker and Poore 1996: 84, 89). Infold of caudal process with smooth, straight ridge. Selvage with lamellar prolongation along anterior to posteroventral parts of margin. Adductor muscle scar consisting of at least 14 individual scars of different sizes. Dorsal margin of right valve in dorsal view forming narrow anterior process (Fig. 2D) and semitriangular posterior process (Fig. 2E). Melanophores observed in parts of anterior half of shell margin and posterior margin as shown in figures.

First antenna (Fig. 3A) eight-segmented. First segment as long as second. Ventral margin of second segment with several minute spines. Third segment about one-sixth as long as second, with two bristles, one dorsoproximal, one ventrodistal. Fourth segment about twice as long as third, with two bristles, one dorsodistal, one ventrodistal. Fifth segment slightly shorter than fourth, with sensory bristle bearing nine long, thick proximal filaments and four slender, unequal distal filaments. Sixth segment about half as long as fifth, with short mediodistal bristle. Details of seventh and eighth segments not clear; a- to e-bristles having length ratio of approximately 1:3:6:3:3; b-bristle with five filaments of different lengths; c-bristle with about eight filaments; f-bristle slightly shorter than c-bristle, with about eight filaments; g-bristle slightly longer than c-bristle, with about nine filaments

Protopode of second antenna (Fig. 3B) with short medial bristle and brown pigmentation. Endopodite (Fig. 3C) unsegmented, small, with long distal bristle and four proximal bristles (two short and two long). Exopodite nine-segmented; first segment as long as combined length of remaining segments; fourth to eighth segments with basal spines increasing in size distally; bristle on second segment hirsute proximally and with six spines along anterior margin; bristles on third to eighth segments with natatory hairs; ninth segment with short basal spine and one short and three natatory bristles.

Mandible (Fig. 3D) with brown pigmentation. Coxale endite semitriangular, with two terminal teeth, many short spines, and one short bristle near base. Ventral margin of basale with three proximal a-bristles, one b-bristle, three c-bristles (one very minute), and one long d-bristle; dorsal margin with three bristles, one proximal, two juxtaposed distal. Exopodite triangular, slightly shorter than dorsal margin of first endopodite segment, with two subterminal bristles, proximal one about three times as long as distal one. First endopodite segment with four ventral bristles of different lengths, the longest with hairs; second segment about six times as long as first, with three separated bristles (left) along distal half of ventral margin (right segment also with three bristles, but distal two juxtaposed) and 16 bris-

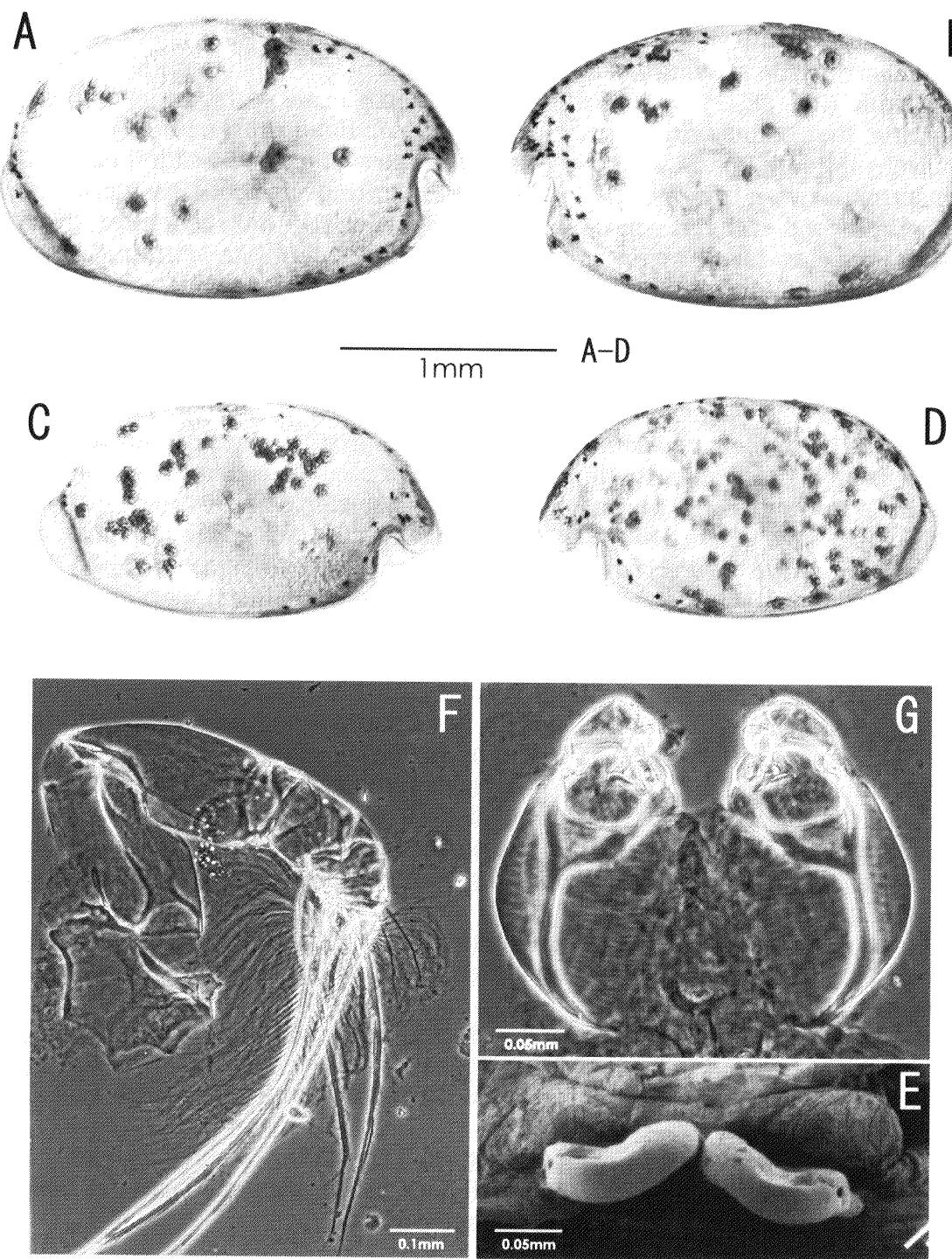


Fig. 1. *Skogsbergia abei* sp. nov., female (A, B, holotype ZIHU2082; E, paratype ZIHU2085) and male (C, D, F, G, allotype ZIHU2086). A, Right valve; B, left valve; C, right valve; D, left valve; E, genitalia; F, first antenna; G, copulatory limb.

ties of different lengths on proximal half of dorsal margin, shortest of these with spinules along both sides; terminal segment small, with three claws and three (right: short bristle missing?) or four (left) bristles.

Maxilla (Fig. 3E, F) with brown pigmentation. Coxale with one long dorsodistal bristle; first endite with about 11 bristles; second and third endites with about 12 bristles in total. Basale with one bristle near base of exopodite. First endopodite segment with two  $\alpha$ -bristles, and two  $\beta$ -bristles; cutting edge consisting of triangular tooth; second segment small, with four (right) or five (left) a-bristles, three b-bristles (two claw-like), two c-bristles, and two strong, claw-like bristles. Exopodite with one proximal bristle and two terminal bristles.

Fifth limb (Fig. 4A) with brown pigmentation. Epipodial appendage with about 54 bristles. Protopodite with three endites; first endite with six bristles; second endite with five bristles; third endite with six bristles. Exopodite four-segmented; lateral surface of first segment with three juxtaposed bristles and one plumose posterior bristle. Main tooth consisting of six teeth and proximal peg; one medial bristle present near base of main tooth; anterior side of second segment with four claw-like a-bristles and seven pectinate b-bristles, posterior c-bristle, and anterior d-bristle; inner lobe of third segment with three bristles, one being proximal; outer lobe of third segment with two terminal bristles; terminal segment (fused fourth and fifth segments) with four bristles and small process on distal margin.

Sixth limb (Fig. 4B) with brown pigmentation. Epipodial appendage with four bristles; first endite with two proximal and two terminal bristles; second endite with two proximal and two terminal bristles; third endite with one proximal and four terminal bristles; fourth endite with two proximal and five terminal bristles; terminal segment hirsute, with 17 (right) or 18 (left) bristles.

Seventh limb (Fig. 4C) with brown pigmentation in proximal part. Each limb with six distal bristles on each side, and 12 (5+7) or 9 (6+3 [some bristles missing]) proximal bristles; each bristle with two to six bells; terminus not clearly visible, with about ten teeth, distalmost being longer and stronger; sclerotized bar opposite teeth, with small terminal teeth.

Furca (Fig. 4D) with brown pigmentation. Each lamella with eight claws; claw 2 continuous with lamella; others separated from lamella by suture; claw 5 stouter than claws 3 and 4.

Genitalia of holotype broken or lost during dissection. Paired structure (spermatophores?) observed in front of furca (Fig. 1E, paratype ZIHU2085). "Setose opening" (Cohen and Morin 1997) of paratype (ZIHU2084) with eight setae (not illustrated).

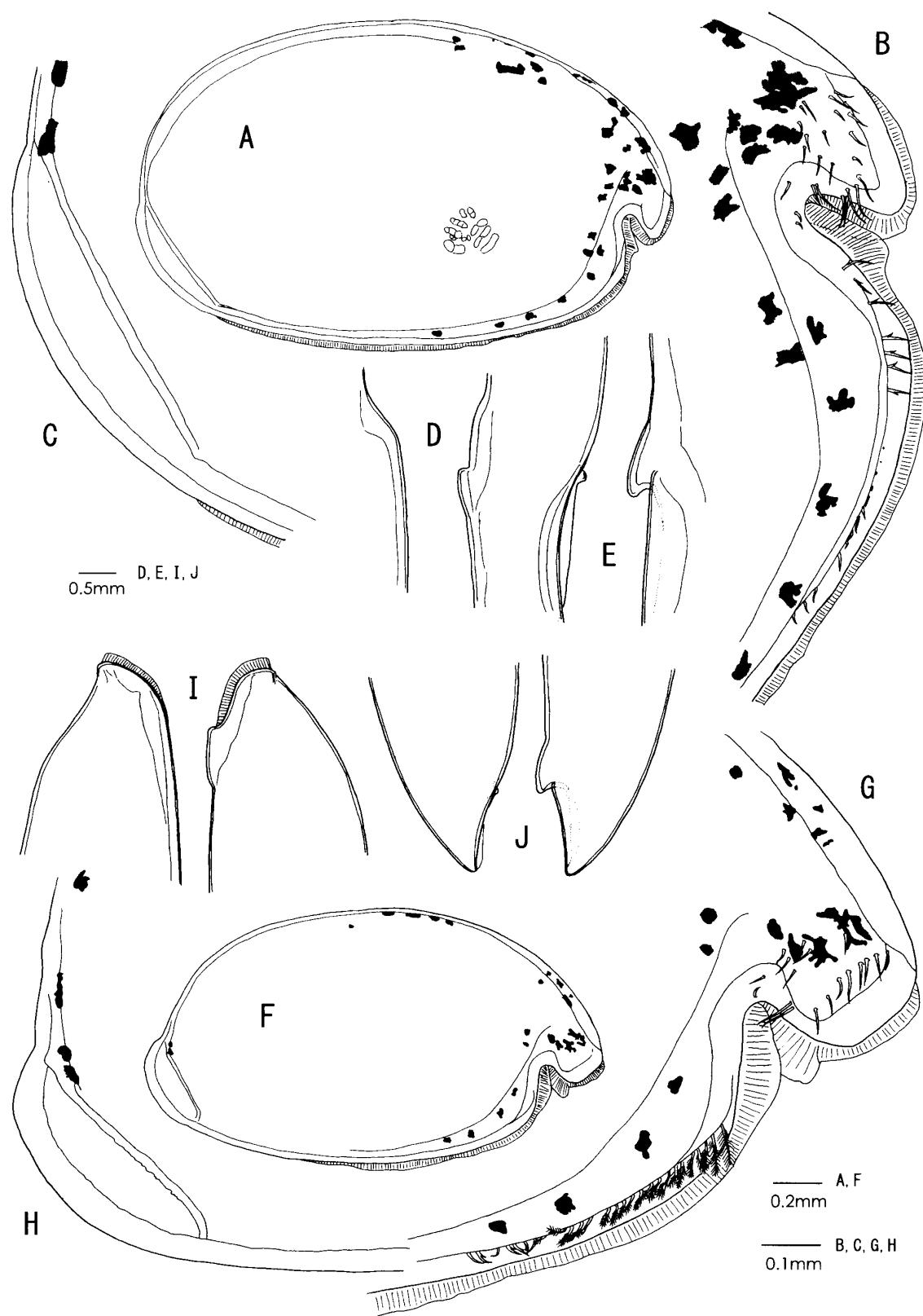
Lateral eyes with dark brown pigment, each consisting of about 28 (right) or 33 (left) ommatidia. Medial eye (Fig. 5A) with dark brown pigment. Organ of Bellonci (Fig. 5A) short, slightly increasing in diameter distally.

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Fig. 2. *Skogsbergia abei* sp. nov., female (A–E, holotype ZIHU2082) and male (F–J, allotype ZIHU2086). A, Medial view of left valve; B, medial view of anterior part of left valve; C, medial view of posterior part of left valve; D, dorsal view of anterior part of both valves; E, dorsal view of posterior part of both valves; F, medial view of left valve; G, medial view of anterior part of left valve; H, medial view of posterior part of left valve; I, dorsal view of anterior part of both valves; J, dorsal view of posterior part of both valves.

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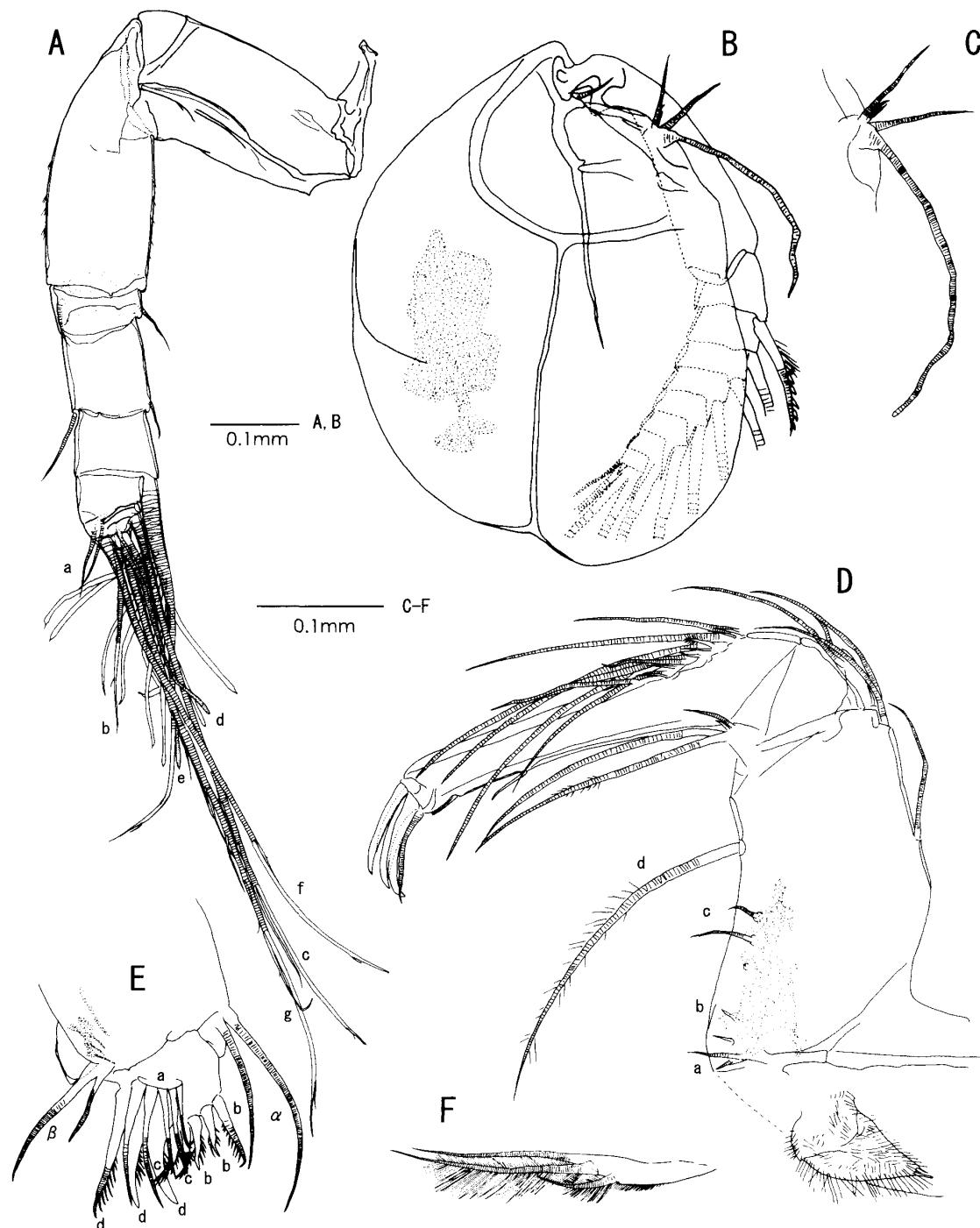


Fig. 3. *Skogsbergia abei* sp. nov., female (holotype ZIHU2082). A, First antenna; B, second antenna; C, ditto, endopodite; D, mandible; E, maxilla, endopodite; F, ditto, exopodite.

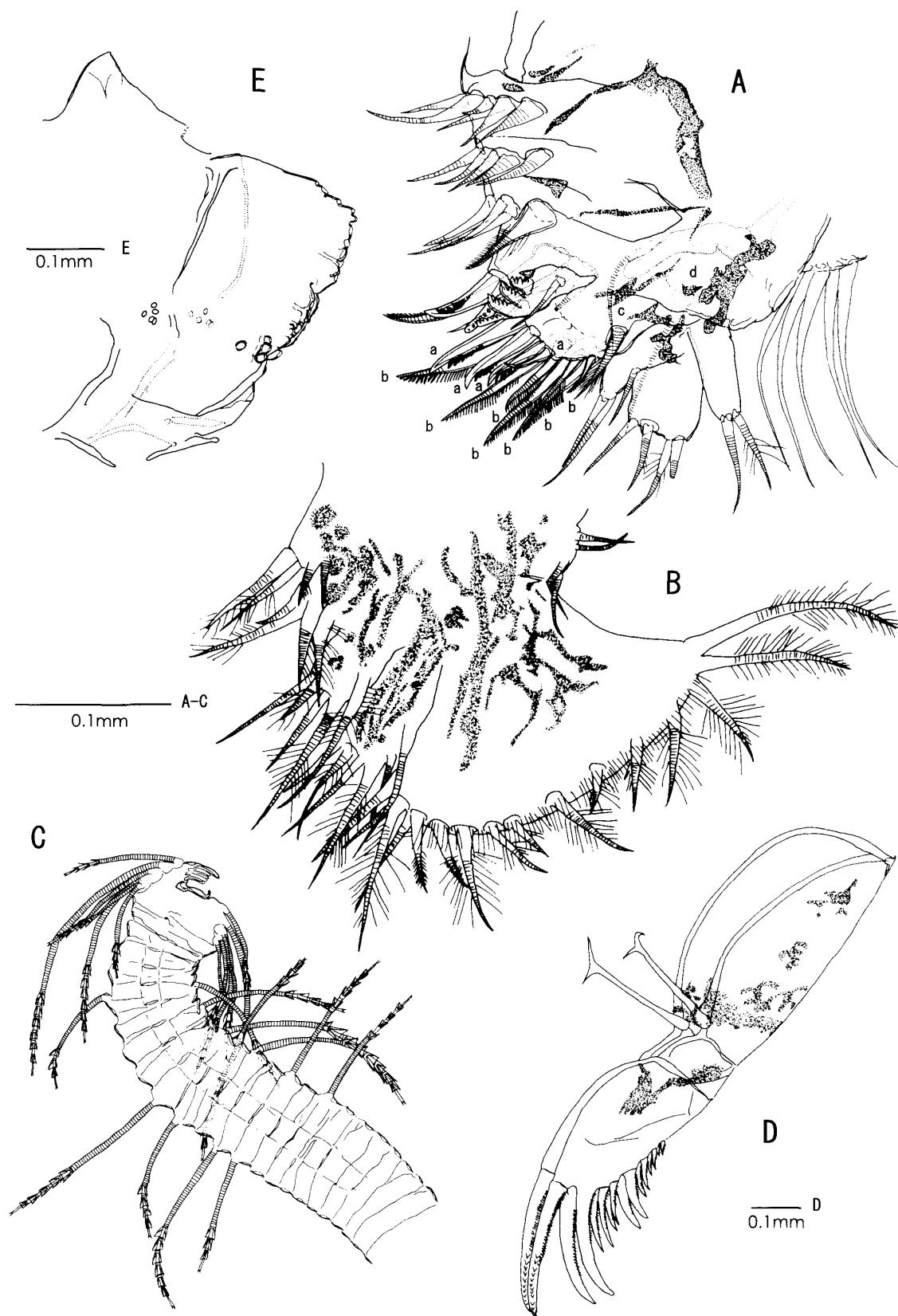


Fig. 4. *Skogsbergia abei* sp. nov., female (holotype ZIHU2082). A, Fifth limb; B, sixth limb; C, seventh limb; D, furca; E, upper lip.

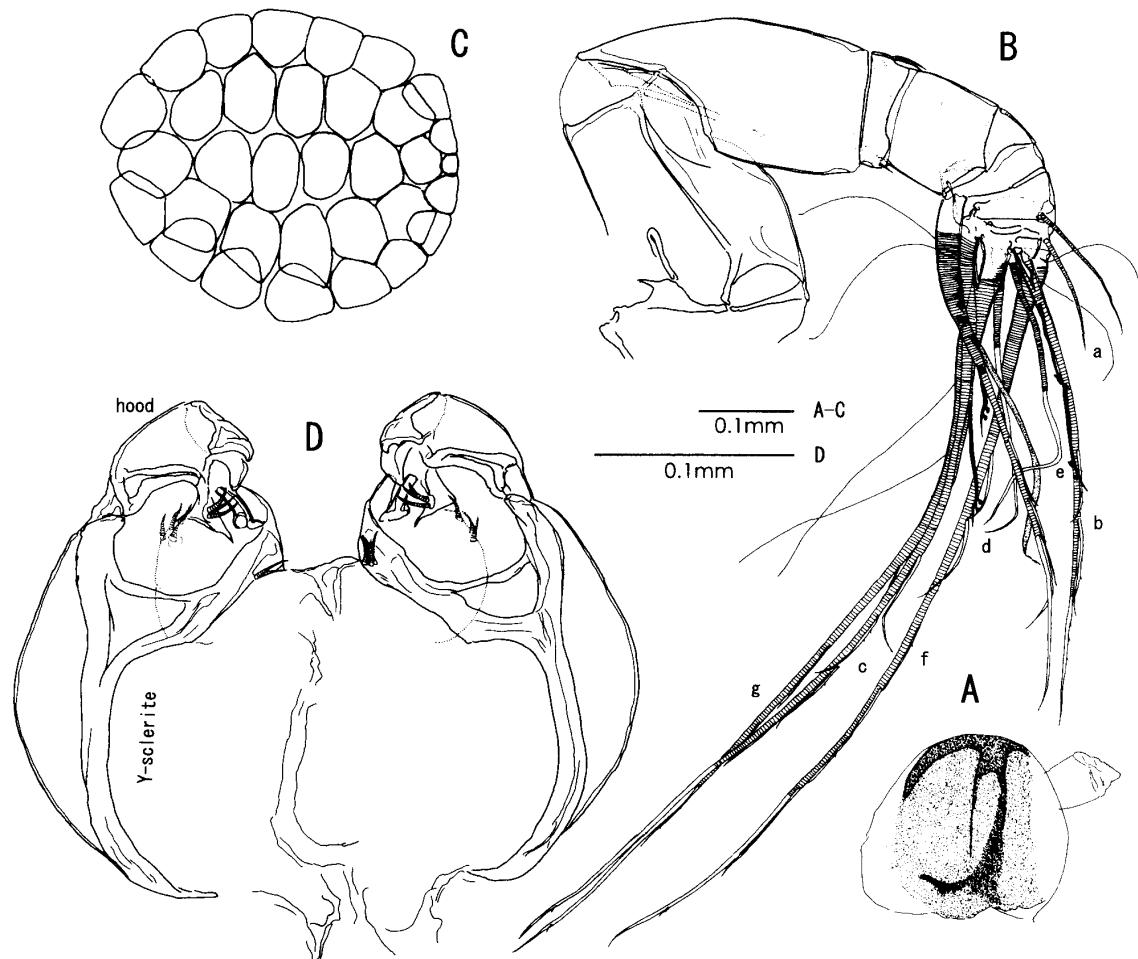


Fig. 5. *Skogsbergia abei* sp. nov., female (A, holotype ZIHU2082) and male (B, D, allotype ZIHU2086; C, paratype ZIHU2088). A, Median eye and organ of Bellonci; B, first antenna; C, lateral eye; D, copulatory limb.

Upper lip (Fig. 4E) entirely with brown pigmentation, without tusks, consisting of unpaired anterior lobe with about ten glandular openings and two pairs of posterior lobes (larger dorsal lobe with about ten glandular openings, small ventral lobe with three glandular openings); one glandular opening present slightly posterior to latter lobe; lateral side of proximal part with five glandular openings.

Spherical epizoa observed in caudal "pocket" of each valve.

*Male* (allotype). Carapace (Figs 1C, D, 2F–J) 1.88 mm long, 1.04 mm high, more slender in lateral view than in holotype (female), with large rostrum. Rostral infold with about 14 bristles; about four bristles of different lengths present along ventral margin of rostrum. Infold in anterior and anteroventral regions with about 27 divided bristles. Posterior margin of ridge of caudal infold serrated. Otherwise similar to female (holotype).

First antenna (Figs 1F, 5B) eight-segmented. First segment as long as second. Third segment about one-eighth as long as second, with two short bristles, one dorsomedial, one ventrodistal. Fourth segment about three times as long as third, with dorsodistal bristle and ventrodistal bristle. Fifth segment as long as third,

with sensory bristle bearing nine long, thick proximal filaments and four slender, distal filaments of different lengths. Sixth segment somewhat longer than fifth, with mediadistal bristle. Details of seventh and eighth segments not clear; a- to g-bristles having length ratio of about 2.8:14:5:5:14:14; b- and c-bristles with one large basal sucker each; proximal two filaments of both b- and c-bristles with two small suckers each; f- and g-bristles with numerous filaments along proximal third and half, respectively.

Copulatory limbs (Figs 1G, 5D) each with broad, oval base; Y-sclerite present on these bases; complex terminal lobes as shown in figure (Cohen and Morin 1993); terminal part of limb (hood) round, sclerotized with strong, teeth-like structure; three setal groups, containing at least three or four setae each, present on terminal lobes.

Second antenna, mandible, maxilla, fifth limb, sixth limb, seventh limb, furca, lateral eye (Fig. 5C), median eye, and upper lip similar to those of female.

**Specimens examined.** Holotype: ♀, ZIHU2082. Paratypes: ZIHU2083 (♀, length 2.21 mm, height 1.38 mm), ZIHU2084 (♀, length 2.08 mm, height 1.30 mm), ZIHU2085 (♀, length 2.20 mm, height 1.35 mm), ZIHU2086 (♂, allotype), ZIHU2087 (♂, length 1.93 mm, height 1.10 mm), ZIHU2088 (♂, length 1.93 mm, height 1.10 mm), ZIHU2089 (♂, length 1.78 mm, height 1.04 mm). Specimens were collected from Tatado (138°56'E, 34°39'N), Shimoda City, Shizuoka Pref., using a baited trap at 3–5 m depth on 1 July 1998 by K. Yamada.

**Remarks.** Kornicker and Poore (1996: 95) wrote, "In the key to species of *Skogsbergia* presented in Kornicker (1992a: 59), *S. tenax* keys closest to *S. menezi* Kornicker, 1970: 10 and *S. strophinx* Kornicker, 1991: 12." This situation also applies to the present new species (cf. Kornicker 1992). Table 1 presents some distinguishing characteristics for these four species (Kornicker 1970, 1991; Kornicker and Poore 1996). *Skogsbergia abei* sp. nov. and *S. tenax* Kornicker and Poore, 1996 have brown pigmentation in their shells and appendages, but in the two other species and all other congeneric species so far known, there are no statements re-

Table 1. Some distinguishing characters of four species of *Skogsbergia*.

	<i>Skogsbergia abei</i> sp. nov.	<i>S. tenax</i>	<i>S. strophinx</i>	<i>S. menezi</i>
Pigmentation	present	present	not mentioned (absent)	not mentioned (absent)
Number of bristles on rostral infold	ca. 20	ca. 60	ca. 14	ca. 16
Number of bristles on terminal segment of sixth limb	17–18	11–13	10–13	14
Number of epipodial appendages of sixth limb	4	4	4	2, 3
"Streamer" (Kornicker and Poore 1996)	absent	present	absent	absent

lating to pigmentation in the descriptions and/or figures. *Skogsbergia tenax* has many more bristles on the rostral infold than the others, and has "streamers" that have not been reported elsewhere in the Myodocopina (Kornicker and Poore 1996). The number of bristles on the terminal segment of the sixth limb in *S. abei* is greater than in the other species. *Skogsbergia menezi* has two or three epipodal appendages on the sixth limb, while the other three species have four.

**Etymology.** The species is named after the late Dr Katsumi Abe of Shizuoka University, an internationally recognized ostracod researcher.

Genus ***Paravargula*** Cohen and Kornicker, 1975  
***Paravargula maculosa*** sp. nov.  
(Figs 6–10)

**Description.** *Female* (holotype). Carapace (Figs 6A, B, 7A–E) 3.85 mm long, 2.00 mm high, elongate oval in lateral view, with shallow incisur and prominent caudal process. Surface smooth in general appearance, but covered with a number of small pits. Anastomosing pattern of integumental circulatory system visible in lateral view (Fig. 6A, B). Rostral infold with about ten bristles; about five bristles of different lengths present along ventral margin of rostrum. Infold in anterior and anteroventral regions with about 40 divided bristles. Ridge on caudal infold with about 20 blunt, conical processes. Selvage with lamellar prolongation along anterior to posteroventral parts of margin. Dorsal margin of right valve in dorsal view forming shallow, anterior tooth-like process and large, semitriangular, posterior tooth-like process as in *Heterodesmus* species (Hiruta 1992). Melanophores of variable size present over entire carapace as shown in Fig. 7A.

First antenna (Fig. 8A) eight-segmented. First segment as long as second. Third segment about one-fifth as long as second, with two bristles, one dorsoproximal, one ventrodistal. Fourth segment about twice as long as third, with two bristles, one dorsodistal, one ventrodistal. Fifth segment two-thirds as long as fourth, with sensory bristle bearing nine long, thick proximal filaments and four slender, distal filaments of different lengths. Sixth segment about half as long as fifth, with medial bristle. Details of seventh and eighth segments not clear; a- to e-bristles having length ratio of approximately 1:2:6:2:2; b- and c-bristles with about ten filaments each; f-bristle slightly shorter than c-bristle, with about nine filaments; g-bristle somewhat longer than c-bristle, with about nine filaments.

Protopodite of second antenna (Fig. 8B) with short medial bristle. Endopodite (Fig. 8C) not segmented, small, with long distal bristle and four proximal bristles (two shorter and two longer). Exopodite nine-segmented; first segment as long as remaining segments combined; third to eighth segments with basal spines increasing in size distally; bristle on second segment (Fig. 8D) hirsute proximally and with about 20 spines along both anterior and posterior margins (some spines missing); bristles on third to eighth segments with natatory hairs; ninth segment with short basal spine and one short and three natatory bristles.

Coxale endite of mandible (Fig. 8E) semitriangular, hirsute, with two terminal teeth and one short bristle near base. Ventral margin of basale with three proximal a-bristles, one b-bristle, three c-bristles (one very minute), and one long d-bristle; dorsal margin with three bristles, one proximal, juxtaposed two distal. Ex-

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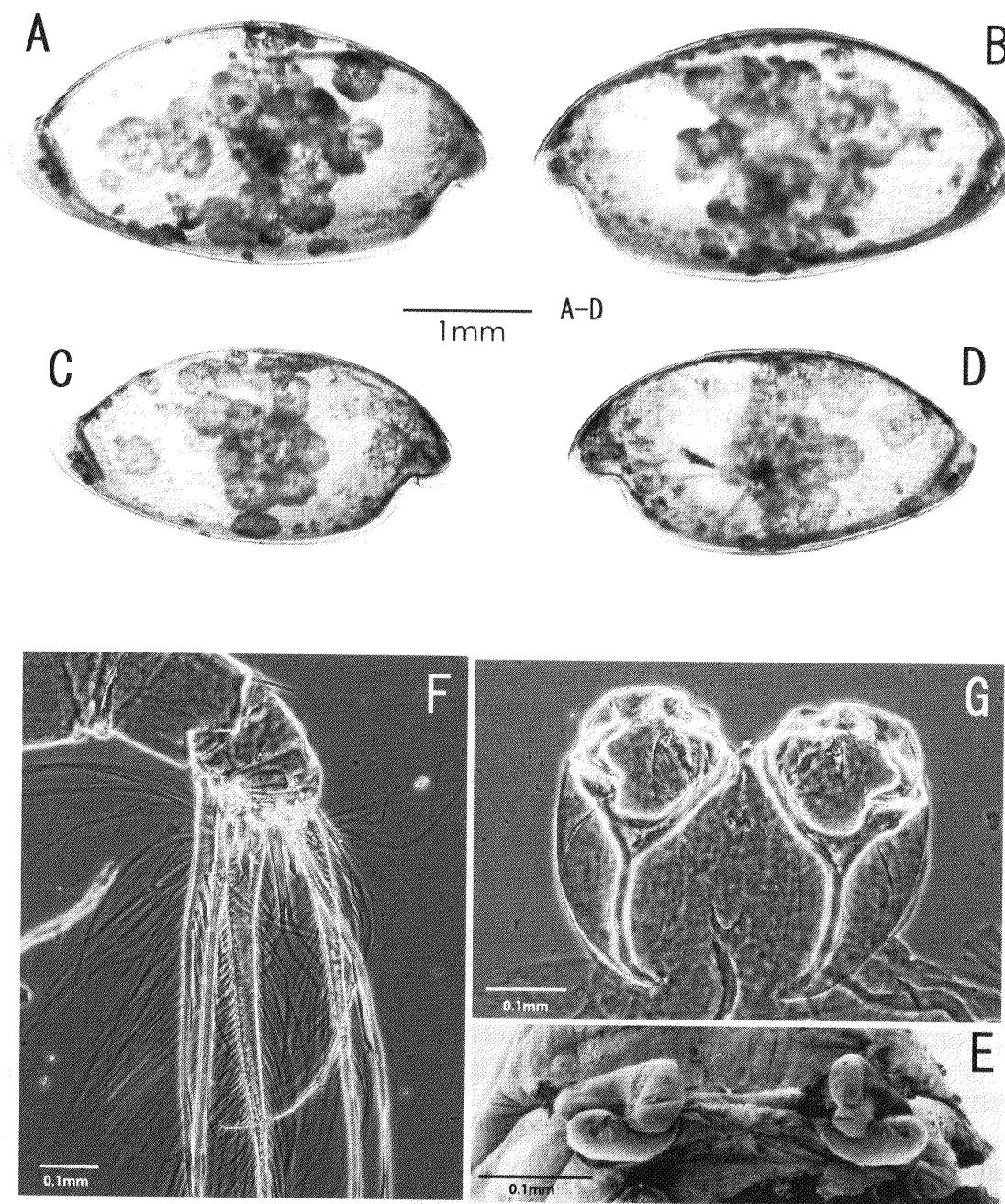


Fig. 6. *Paravargula maculosa* sp. nov., female (A, B, holotype ZIHU2074; E, paratype ZIHU2078) and male (C, D, F, G, allotype ZIHU2079). A, Right valve; B, left valve; C, right valve; D, left valve; E, genitalia; F, first antenna; G, copulatory limb.

opodite triangular, about same length as dorsal margin of first endopodite segment, with two subterminal bristles, proximal one about four times as long as distal one. First endopodite segment with four ventral bristles of varying lengths, the longest with hairs; second segment about six times as long as first, with three bristles and about 15 minute spines on ventral margin and two groups of bristles on dorsal margin, proximal group consisting of two long and seven short bristles, dis-

tal group with six long and two short bristles; terminal segment small, with three claws, three bristles, and minute ventrodistal spine.

Coxale of maxilla with one long dorsodistal bristle; first endite with about 11 bristles; second and third endites with about 14 bristles in total. Basale with one bristle near base of exopodite. First endopodite segment (Fig. 8F) with two  $\alpha$ -bristles and two  $\beta$ -bristles; cutting edge consisting of one tooth; second segment (Fig. 8F) small, with four a-bristles, three b-bristles, two c-bristles, and three d-bristles. Exopodite (Fig. 8G) with one proximal bristle and two terminal bristles.

Epipodial appendage of fifth limb (Fig. 9A) with about 54 bristles. Protopodite with three endites; first endite with eight bristles; second endite with six bristles; third endite with five bristles. Exopodite four-segmented; lateral surface of first segment with three juxtaposed bristles and one plumose posterior bristle. Main tooth consisting of six teeth and proximal peg; medial bristle present near base of main tooth; anterior side of second segment with four claw-like a-bristles and seven pectinate b-bristles, posterior c-bristle, and anterior d-bristle; inner lobe of third segment with three bristles, one being proximal; outer lobe of third segment with two terminal bristles; terminal segment (fused fourth and fifth segments) with four bristles.

Epipodial appendage of sixth limb (Fig. 9B) with four bristles; first endite with two proximal and two terminal bristles; second endite with two proximal and two terminal bristles; third endite with one proximal and four terminal bristles; fourth endite with two proximal and five terminal bristles; terminal segment hirsute, with 16 bristles.

Seventh limb (Fig. 9C, D) with 13 distal bristles, six arising from peg side, seven from comb side; right limb with 11 (4+7) proximal bristles; left limb with nine (3+6) proximal bristles; each bristle with two to eight bells; terminal comb with about seven teeth on each side and one sclerotized middle claw; two pegs present opposite comb.

Furca (Fig. 9E) with weak brown pigmentation near base. Each lamella with ten claws; claw 2 continuous with lamella, others separated from lamella by suture; claw 5 slightly stouter than claw 4.

Genitalia of holotype lost during dissection. Genital limb and spermatophores (?) of paratype (ZIHU2078) shown in Fig. 6E. "Setose opening" of paratype (ZIHU2077) with about seven setae.

Lateral eyes with dark brown pigment; each eye consisting of more than 30 ommatidia. Medial eye (Fig. 10A) with dark brown pigment. Organ of Bellonci (Fig. 10A) short, slightly increasing in diameter distally.

Upper lip (Fig. 9F) with weak brown pigmentation in proximal area and near ventral margin. Consisting of unpaired, elongate dorsal lobe with four glandular openings on distal margin; large pair of anterior lobes each with long, tapering

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Fig. 7. *Paravargula maculosa* sp. nov., female (A–E, holotype ZIHU2074) and male (F–J, allotype ZIHU2079). A, Medial view of right valve; B, medial view of anterior to ventral part of right valve; C, medial view of posterior part of right valve; D, dorsal view of anterior part of both valves; E, dorsal view of posterior part of both valves; F, medial view of right valve; G, medial view of anterior to ventral part of right valve; H, medial view of posterior part of right valve; I, dorsal view of anterior part of both valves; J, dorsal view of posterior part of both valves.

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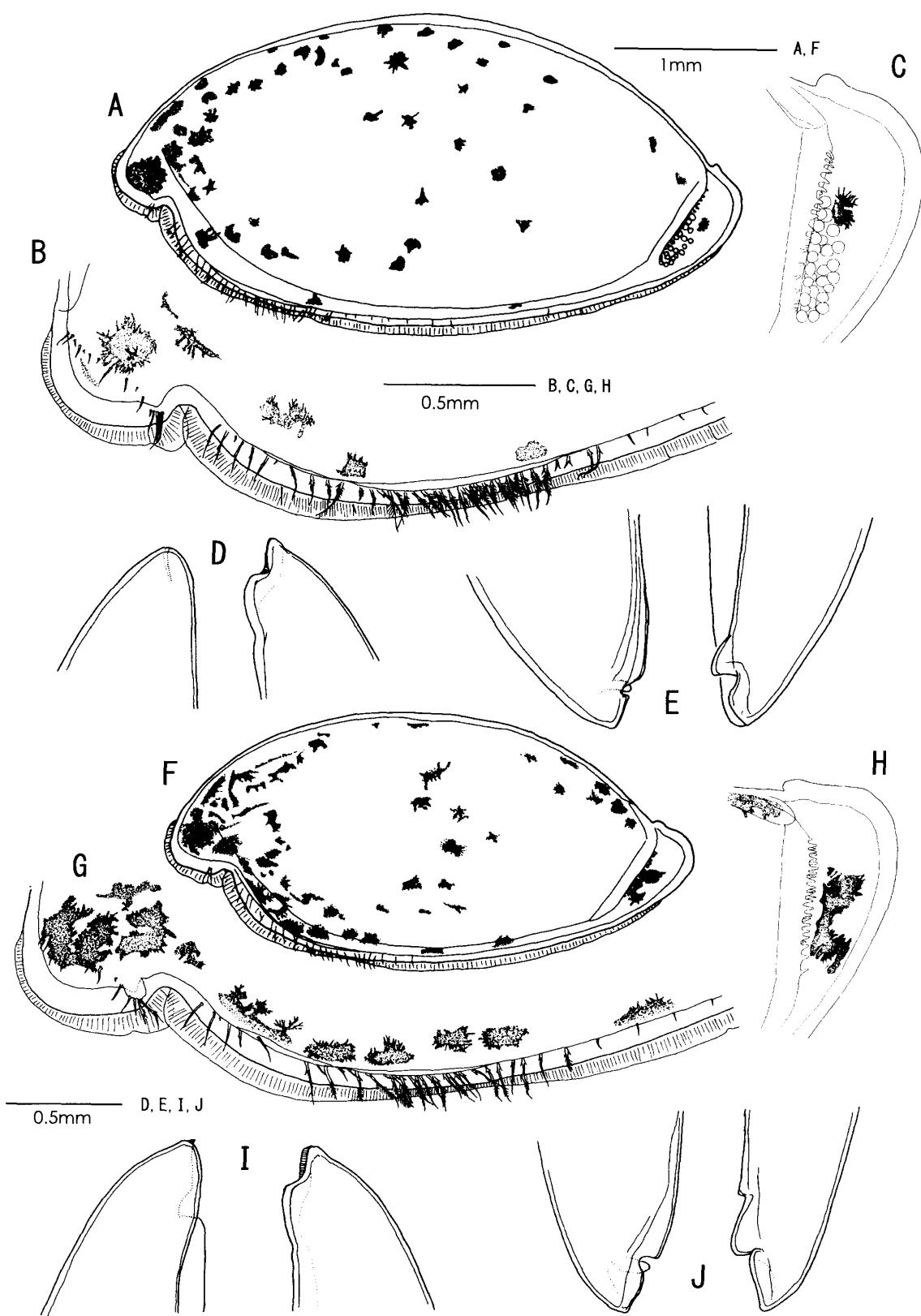




Fig. 8. *Paravargula maculosa* sp. nov., female (holotype ZIHU2074). A, First antenna; B, second antenna; C, ditto, endopodite; D, ditto, bristle of second exopodite segment; E, mandible; F, maxilla, distal part of endopodite; G, ditto, exopodite.

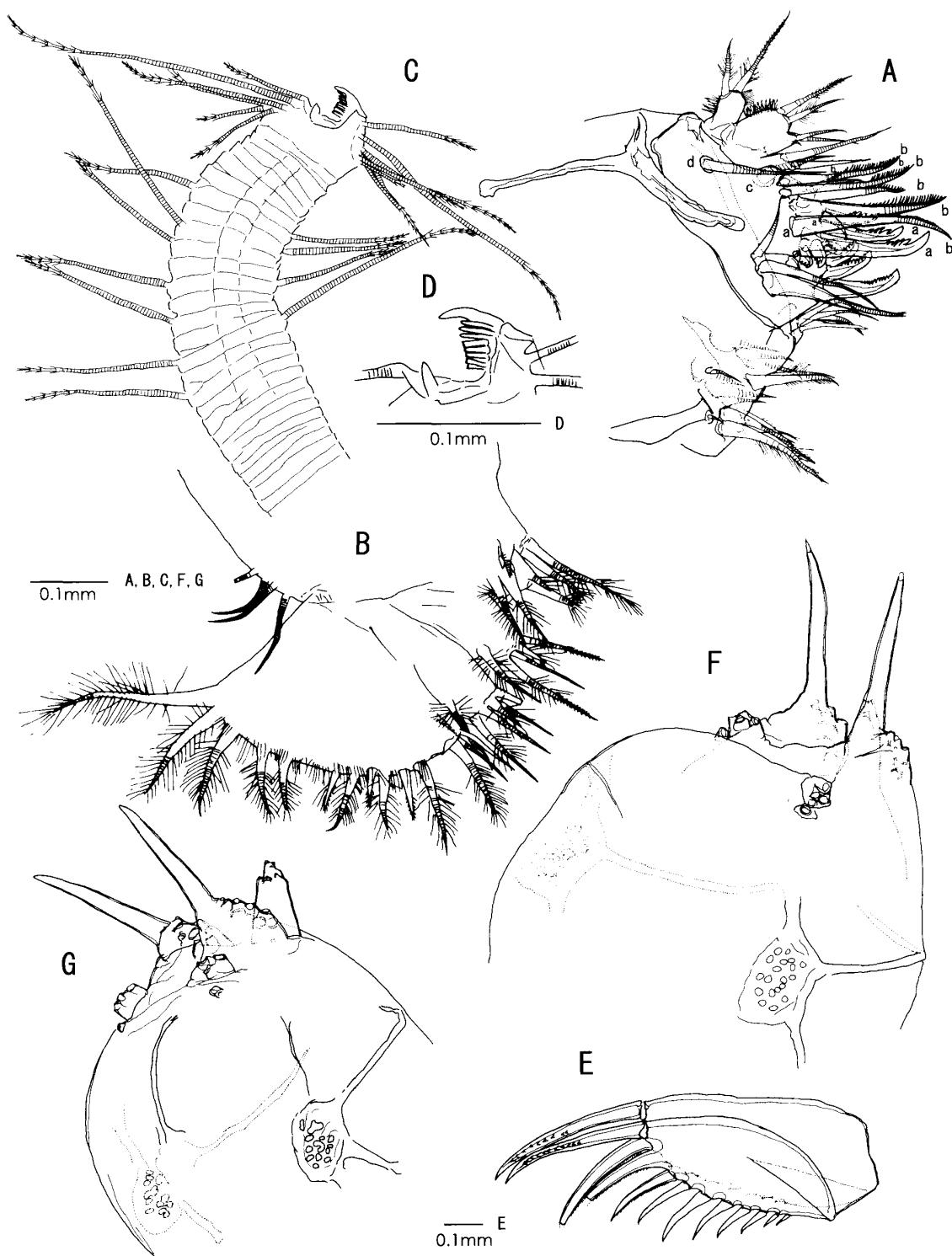


Fig. 9. *Paravargula maculosa* sp. nov., female (A–F, holotype ZIHU2074) and male (G, allo-type ZIHU2079). A, Fifth limb; B, sixth limb; C, seventh limb; D, ditto, distal part; E, furca; F, upper lip; G, ditto.

tusk ventrodistally and several glandular openings on anterior surface; small paired lobes with four glandular openings each. Another glandular opening on ventrolateral flank, and lateral side of proximal part with at least 19 glandular openings.

Spherical epizoa (Fig. 7C) observed in caudal "pocket" of right valve.

**Male** (allotype). Carapace (Figs 6C, D, 7F–J) 3.23 mm long, 1.90 mm high, with shallow incisur and prominent rostrum, similar to female in lateral view, but more elongate. Otherwise similar to female.

First antenna (Fig. 10B) eight-segmented. First segment as long as second. Third segment about one-fifth as long as second, with two short bristles, one dorso-medial, one ventromedial. Fourth segment about twice as long as third, with dor-sodistal bristle and ventrodistal bristle. Fifth segment one-third as long as fourth, with sensory bristle bearing nine long, thick filaments and four slender, distal filaments of different lengths. Sixth segment as long as fifth, with mediadistal bristle. Details of seventh and eighth segments not clear; a- to e-bristles having length ratio of approximately 2:10:18:5:5; b- and c-bristles with one large basal sucker each; proximal two filaments of both b- and c-bristles with three small suckers each; f- and g-bristles somewhat shorter than c-bristle, with numerous filaments along proximal third and half, respectively.

Each copulatory limb (Figs 6G, 10D) oval in general appearance, with broad basal part; Y-sclerite present on these bases; complex terminal lobes as shown in figures; terminal part of limb (hood) sclerotized, with serrate ridge and spinous surface; several groups of short setae present on terminal lobes.

Second antenna, mandible, maxilla, fifth limb, sixth limb, seventh limb, furca, lateral eye (Fig. 10C), median eye, and upper lip (Fig. 9G) similar to those of female.

**Specimens examined.** Holotype: ♀, ZIHU2074. Paratypes: ZIHU2075 (♀, length 3.53 mm, height 1.83 mm); ZIHU2076 (♀, length 3.80 mm, height 1.95 mm), ZIHU2077 (♀, length 3.63 mm, height 1.88 mm), ZIHU2078 (♀, length 3.70 mm, height 1.90 mm), ZIHU2079 (♂, allotype), ZIHU2080 (♂, length 3.20 mm, height 1.55 mm), ZIHU2081 (♂, length 3.25 mm, height 1.65 mm). Specimens were collected from Sotoura (138°59'E, 34°41'N), Shimoda City, Shizuoka Pref., using a baited trap at 2–4 m depth on 18 May 1997 by K.Yamada.

**Remarks.** The present new species resembles *Paravargula digitata* Kornicker, 1970 from the Philipines and *P. trifax* Kornicker, 1991 from Enewetak Atoll, the Marshall Islands, in general morphology of shell and the upper lip (cf. Kornicker 1970, 1991). The incisur of *P. maculosa* sp. nov. is shallower than those of these two species. In *P. digitata* and *P. trifax*, the ridge on caudal infold is furnished with digitate processes, while the corresponding processes in *P. maculosa* are not digitate but end in a blunt tip. Although *P. digitata* is known from only the A-1 male, we doubt that the characteristics of the incisur and the digitate processes appear only in juvenile stages. They are very distinctive and probably appear in the adult stage as well. *Paravargula digitata* has no pigmentation, and *P. trifax* has black pigmentation only in the dorsal and posterior parts of body, whereas *P. maculosa* shows brown pigmentation in the shell, upper lip, and furca.

**Etymology.** The specific name is derived from Latin *maculosus*, meaning spotted, in reference to the pigmentation of the carapace.

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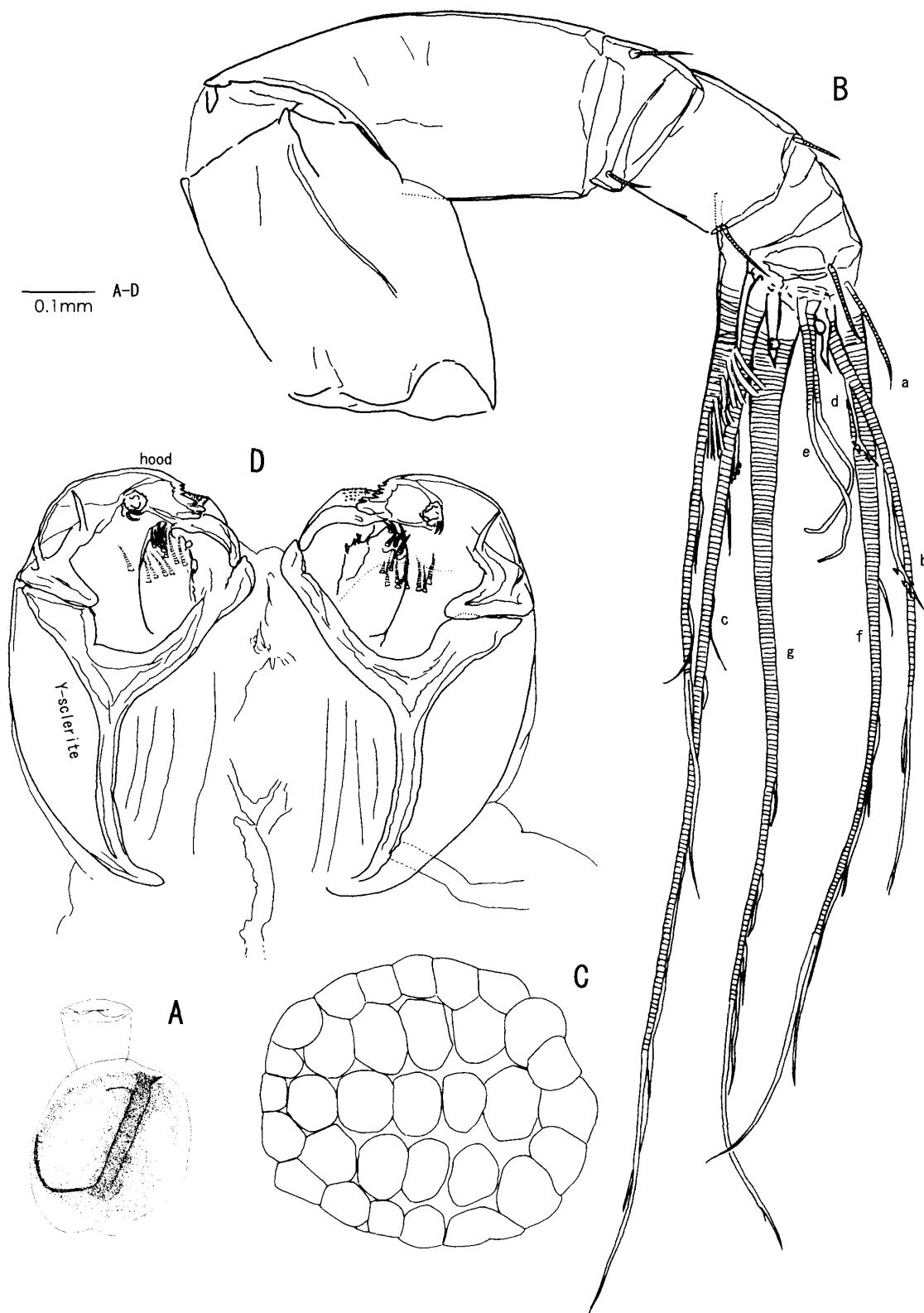


Fig. 10. *Paravargula maculosa* sp. nov., female (A, holotype ZIHU2074) and male (B, D, allo-type ZIHU2079; C, paratype ZIHU2080). A, Median eye and organ of Bellonci; B, first antenna; C, lateral eye; D, copulatory limb.

### Acknowledgments

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